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Manipal Institute of Technology, Manipal





III SEMESTER B.TECH (MECHATRONICS ENGINEERING) END SEMESTER EXAMINATIONS, DEC-15/JAN-16

LINEAR INTEGRATED CIRCUITS AND APPLICATIONS [MTE-2104]

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ALL FIVE FULL the questions.
- ✤ Missing data may be suitably assumed.
- 1A. With a neat functional block diagram elaborate the working of IC 555 in (5) Astable mode. Draw the capacitor and output waveforms. Why the mode is called Astable?
- **1B.** Find the range in which the output voltage can be varied with the help of (3) LM317 regulator. Draw the circuit. $R_1 = 820\Omega$ and $R_2 = 10k\Omega$ pot
- 1C. Using Op-amps design an Inverting Schmitt Trigger whose LtP and UTP are $\pm 10V$. Also draw the waveform (2)
- 2A. Most domestic central heating systems only operate when the temperature is below a preset level. In an air conditioning system, the temperature of the room air is not only heated when the temperature is too low but the air can also be cooled when the temperature is too high. This could easily be done by incorporating a fan. Identify and design a suitable circuit. Also, explain its operation.
- **2B.** With a neat diagram elucidate the working of an Instrumentation Amplifier **(3)** and derive the output equation.
- 2C. Design an opamp circuit for an input current of 0.1mA (for each source) for (3) 2V input signal to provide an output of

$$V_0 = -\left[3V_1 + \frac{1}{2}V_2\right]$$

- **3A.** With a neat diagram derive the expression for closed loop voltage gain and **(5)** input impedance of a practical Non-Inverting amplifier.
- **3B.** Solve the following 2nd order Differential Equation using Op-amps (3) $\frac{d^2V_1}{dt^2} + 20\frac{dV_1}{dt} + 100V_1 - 25V_2 = 0$
- **3C.** Using Opamp 741 design a mathematical circuit that gives the square root of (2) an input voltage

- 4A. Design a 1st order filter which rejects all frequencies between 400Hz and (5) 2kHz that has a pass band gain of 2. What is the roll off rate for this filter? Sketch the response of the filter.
- **4B.** Explain the working of Dual Slope ADC and show that the input voltage is **(4)** proportional to the digital count obtained in the counter.
- 4C. For a basic Op-Amp integrator circuit, time constant is 1sec. If the input is a (2) step wave of amplitude 2V, determine the output voltage and draw the waveform.
- 5A. Define the following terms related to Data Converters: Resolution; Accuracy; (4) Find the resolution of a 4 bit R-2R ladder. Also find its Input-Output equation and output voltage if the digital count is 1111.
- **5B.** With a neat block diagram, explain the working of PLL.
- **5C.** Calculate the output voltage of the circuit shown in **Fig.5(C)**. Given (3) $V_i=2V,R_1=1k\Omega, R_2=2k\Omega, R_3=3k\Omega, R_4=3k\Omega$.



(3)